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# Kinetics of the chiral phase transition in a quark-meson $\sigma$ model

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A challenging goal in relativistic heavy-ion physics is the investigation of the phase diagram of strongly interacting matter and the determination of its phase structure, governed by the approximate chiral symmetry of the light-quark sector of QCD. In this study [1] we investigate a linear quark-meson $\sigma$ model in and out of equilibrium employing Schwinger-Keldysh real-time techniques to derive a set of coupled Boltzmann-Uehling-Uhlenbeck (BUU) equations for the $\sigma$-mean field (the order parameter of the phase transition) and the quark- and meson phase-space distribution function from a $\Phi$-derivable approximation, which is then numerically solved using an accurate quadrature algorithm to evaluate the collision terms. This numerical scheme is used to evaluate the grand-canonical baryon-number fluctuations for an expanding fireball. Even when starting with a purely Gaussian initial distribution the evolution results in a temporary buildup of higher-order fluctuations of the net-baryon number like the curtosis at low momenta when the system is evolving close to the critical point or the first-order phase-transition line. This is mainly caused by the slowly evolving $\sigma$-mean field, i.e., the order parameter of the phase transition. This is partially counterballanced by the further dissipative evolution due to collisions of the quarks, mesons, and the mean field, leading to a considerable weakening of the final fluctuations, depending on the expansion rate of the fireball.

[1] Annals of Physics **431**, 168555 (2021)

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